

CLAIMS:

1. A warm-up method for an internal combustion engine (1) provided with a CO<sub>2</sub> absorbing and releasing agent (15) so as to be able to absorb CO<sub>2</sub> contained in an exhaust gas in a first temperature range, and to release the CO<sub>2</sub> absorbed therein in a second temperature range that is higher than the first temperature range, the warm-up method characterized in that a temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought into the second temperature range so as to supply the CO<sub>2</sub> released from the CO<sub>2</sub> absorbing and releasing agent (15) into a component of the internal combustion engine (1).

2. The warm-up method according to claim 1, characterized in that the component comprises an exhaust gas purification catalyst (10) that purifies the exhaust gas discharged from the internal combustion engine (1).

3. The warm-up method according to claim 1 or 2, characterized in that the component comprises at least one of an intake manifold (3a) and a cylinder (2) of the internal combustion engine (1).

4. The warm-up method according to any one of claims 1 to 3, characterized in that the temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought into the first temperature range after a command for stopping the internal combustion engine (1) is issued, and the temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is further increased to be brought into the second temperature range after a command for starting the internal combustion engine (1) is issued.

5. A warm-up system for an internal combustion engine provided with a CO<sub>2</sub> absorbing and releasing agent (15) so as to be able to absorb CO<sub>2</sub> contained in an exhaust gas in a first temperature range, and to release the CO<sub>2</sub> absorbed therein in a second temperature range that is higher than the first temperature range, the CO<sub>2</sub> absorbing and releasing agent (15) being provided to supply the CO<sub>2</sub> released therefrom to a component of the internal combustion engine (1), the warm-up system characterized by comprising:

a heating unit that increases a temperature of the CO<sub>2</sub> absorbing and releasing agent (15); and

a temperature control unit (18) that controls an operation of the heating unit such that the temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought into the second temperature range.

5           6.       The warm-up system according to claim 5, characterized in that the heating unit comprises an electric heater (16).

7.       The warm-up system according to claim 5 or 6, characterized by further comprising an EGR passage (14) that connects an exhaust passage (4) and an  
10       intake passage (3) of the internal combustion engine (1), and an EGR valve (13) that selects an operation between connection and disconnection of the EGR passage, characterized in that:

15               the CO<sub>2</sub> absorbing and releasing agent (15) is provided in the exhaust passage upstream of a joint portion between the EGR passage and the exhaust passage;

              the component comprises an exhaust gas purification catalyst (10) provided downstream of the joint portion; and

              the temperature control unit (18) controls an operation of the EGR valve (13) such that the EGR passage is disconnected when the temperature of the  
20       CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought into the second temperature range.

8.       The warm-up system according to claim 5 or 6, characterized by comprising a turbo charger (7) having a variable nozzle (7c) in an exhaust turbine  
25       (7b), characterized in that:

              the CO<sub>2</sub> absorbing and releasing agent (15) is provided in the exhaust passage upstream of the turbo charger;

              the component comprises an exhaust gas purification catalyst (10) provided downstream of the turbo charger; and

30               the temperature control unit (18) opens the variable nozzle (7c) when the temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought into the second temperature range.

9. The warm-up system according to claim 5 or 6, characterized by comprising a turbo charger (7) having a variable nozzle (7c) in an exhaust turbine (7b), characterized in that:

5 the CO<sub>2</sub> absorbing and releasing agent (15) is provided in the exhaust passage downstream of the turbo charger;

the component comprises an exhaust gas purification catalyst (10) provided downstream of the turbo charger; and

10 the temperature control unit (18) closes the variable nozzle (7c) when the temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought into the second temperature range.

10. The warm-up system according to claim 5 or 6, characterized by comprising an EGR passage (14) that connects an exhaust passage (4) and an intake passage (3) of the internal combustion engine (1) and an EGR valve (13) that selects  
15 an operation between connection and disconnection of the EGR passage, characterized in that:

the CO<sub>2</sub> absorbing and releasing agent (15) is provided in the exhaust passage upstream of a joint portion between the EGR passage and the exhaust passage;

20 the component comprises at least one of an intake manifold (3a) and a cylinder (2) of the internal combustion engine (1); and

the temperature control unit (18) controls an operation of the EGR valve (13) such that the EGR passage is connected when the temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought into the second  
25 temperature range.

11. The warm-up system according to claim 10, characterized by comprising a turbo charger (7) having a variable nozzle (7c) in an exhaust turbine (7b), characterized in that the temperature control unit (18) closes the variable nozzle  
30 (7c) when the temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought into the second temperature range.

12. The warm-up system according to any one of claims 5 to 11, characterized in that:

the internal combustion engine (1) is provided with a throttle valve (9);  
and

the temperature control unit (18) closes the throttle valve when the  
temperature of the CO<sub>2</sub> absorbing and releasing agent (15) is increased to be brought  
5 into the second temperature range.

13. The warm-up system according to any one of claims 5 to 12,  
characterized in that the temperature control unit (18) controls the heating unit to  
increase the temperature of the CO<sub>2</sub> absorbing and releasing agent (15) to be brought  
10 into the first temperature range after a command for stopping the internal combustion  
engine (1) is issued, and to further increase the temperature of the CO<sub>2</sub> absorbing and  
releasing agent (15) to be brought into the second temperature range after a command  
for starting the internal combustion engine (1) is issued.